VALVE ACCESSORIES & CONTROLS, INC.

VAC D500
Electro-Pneumatic Positioner

Compact, well-proven, and flexible

High air capacity

Diagnostics capability

Resistant to overpressure

Robust and environm   entally ruggedized

Easy to commission

Approvals for explosion protection
— ATEX
— IECEx
— FM / CSA
— GOST

For SIL2 safety loop

Extended diagnostics

VAC D500
Electro-Pneumatic Positioner

Brief description

The VAC D500 is an electronically configurable positioner with communication capabilities designed for mounting to pneumatic linear or part-turn actuators. It features a small and compact design, a modular construction, and an excellent cost-performance ratio.

Fully automatic determination of the control parameters and adaptation to the final control element yield considerable time savings and an optimal control behavior.

Pneumatics

An I/P module with subsequent pneumatic amplifier is used to control the pneumatic actuator. The well-proven I/P module proportionally converts the permanent electrical setpoint signal from the CPU into a pneumatic signal used to adjust a 3/3-way valve.

The air flow for pressurizing or depressurizing the actuator is continuously adjusted. As a result, excellent control is achieved. When reaching the setpoint, the 3/3-way valve is closed in center position to minimize the air consumption. Four different pneumatics versions are available: for single-acting or double-acting actuators, each with "fail-safe" or "fail-freeze" function.

"Fail-safe" function

If the electrical supply power fails, the positioner output 1 is depressurized, and the pneumatic actuator's return spring moves the valve to the defined safe position. In case of a double-acting actuator the second output 2 is additionally pressurized.

"Fail-freeze" function

If the electrical supply power fails, the positioner output 1 (and 2, if applicable) is closed and the pneumatic actuator stops ("freezes") the valve in the current position. If the compressed air supply power fails, the positioner depressurizes the actuator.

Operation

The positioner has a built-in LCD-indicator with a multi-line LCD display and 4 pushbuttons for commissioning, configuration, and monitoring during live operation. Alternatively, the appropriate DTM/EDD can be used via the available communication interface.

Communication

The positioner supports HART5 and HART7 communication.

Inputs / Outputs

In addition to its input for the analog position setpoint, the positioner is equipped with a digital input which can be used to activate control system functions in the device. A digital output allows you to output collective alarms or fault messages.

Modular design

The basic model can be enhanced at any time by retrofitting optional equipment.

Option modules for analog and digital feedback, an emergency shutdown module, and pressure sensors for valve diagnostics can be installed.

A module for a universal analog input can also be installed to which any device supplying a 4 … 20 mA signal can be connected.

Additionally, a mechanical position indicator, proximity switches or 24 V microswitches are available for indicating the position independently of the mother board function.

Diagnostics

The positioner has three optional pressure sensors which can be used for reliable diagnostics of the valve, the pneumatic drive, and the positioner.
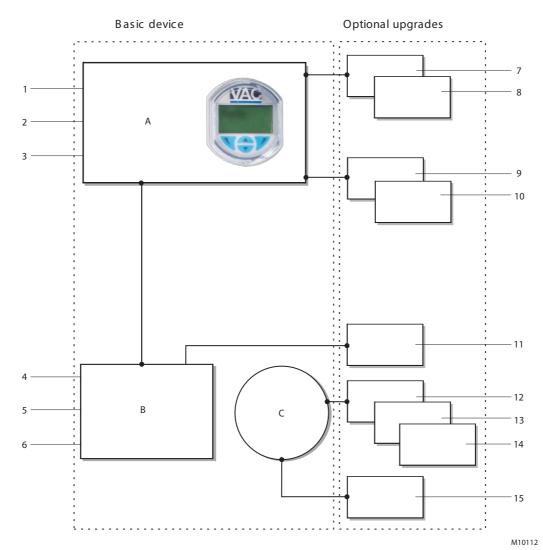
Schematic representation

M10112

Fig. 1:   Schematic diagram of the positioner

A Electronic | B Pneumatic | C Position sensor |

1 4 ... 20 mA / bus connection | 2 Digital input | 3 Alarm output | 4 Supply air | 5 Output 1 | 6 Output 2 |
7 Analog feedback | 8 Binary feedback | 9 Shutdown module | 10 Universal input | 11 Pressure sensor |
12 Mechanical end position switch 24 V microswitch | 13 Proximity switches (NC) | 14 Proximity switches (NO) |
15 Optical position indicator

IMPORTANT (NOTE)
With optional upgrades either the "mechanical feedback with pr oximity switches" (13 or 14) or the "mechanical feedback with microswitch 24 V" (12) can be used.
Only two different plug-in modules can ever be used.

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Mounting versions

To linear actuators in accordance with the standard

Lateral attachment is in accordance with DIN / IEC 534 (lateral attachment to NAMUR). The required attachment kit is a complete set of attachment material, but does not include the screwed pipe connections and air pipes.
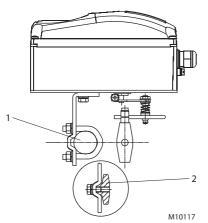

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Fig. 2: Mounting to linear actuators to DIN/IEC 534
1 Columnar yoke | 2 Cast iron yoke

To rotary actuators in accordance with the standard

This attachment is designed for mounting according to the standard VDI/VDE 3845. The attachment kit consists of a console with mounting screws for mounting on a rotary actuator. The adapter for coupling the positioner feedback shaft to the actuator shaft has to be ordered separately. Screwed pipe connections and air pipes have to be provided on site.
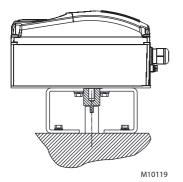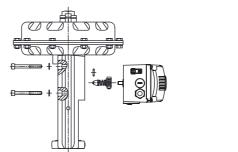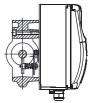

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Fig. 3: Mounting to rotary actuators to VDI/VDE 3845

Integral mounting to control valves

The positioner featuring standard pneumatic action is available as an option for integral mounting.
The required holes are found at the back of the device.
The benefit of this design is that the point for mechanical stroke measurement is protected and that the positioner and actuator are linked internally. No external tubing is required.

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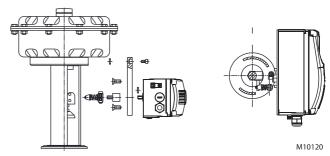Fig. 4: Integral mounting to control valves

M10120

Fig. 5: Integral mounting to control valves by using an adapter panel

Special actuator-specific mounting

In addition to the mounting methods described above, there are special actuator-specific attachments.

Device parameters

General remarks

Microprocessor-based position control in the positioner optimizes control. The positioner features high-precision control functions and high operational reliability. Due to their elaborate structure and easy accessibility, the device parameters can be quickly adapted to the respective application.

The total range of parameters includes:
— Operating parameters
— Adjustment parameters
— Monitoring parameters
— Diagnostics parameters
— Maintenance parameters

Operating parameters

The following operating parameters can be set manually if required:

Setpoint signal

0 ... 100 % freely selectable for split-range operation

For 4 ... 20 mA and HART version:
— Signal min. 4 mA, max. signal 20 mA (0 ... 100 %)
— Min. range 20 % (3.2 mA)
— Recommended range > 50 % (8.0 mA)

Action (setpoint signal)
Increasing:
Position value 0 ... 100 % = direction 0 ... 100 %
Decreasing:
Setpoint signal 100 ... 0 % = direction 0 ... 100 %

Characteristic curve (trave l = f {setpoint signal})
Linear, equal percentage 1:25 or 1:50 or 25:1 or 50:1 or freely configurable with 20 reference points.

Travel limit

The positioning travel, i.e. the stroke or angle of rotation, can be reduced as required within the full range of 0 ... 100 %, provided that a minimum value of 20% is observed.

Shut-off function

This parameter can be set separately for each end position. When the respective configured limit value is exceeded, the shut-off function causes immediate travel of the actuator until reaching the set end position.
When the shut-off value is set to "0", the position is further controlled, even in the respective end position.

Travel time prolongation

This function can be used to increase the max. travel time for full travel. This time parameter can be set separately for each direction.

Switching points for the position

You can use these parameters to define two position limits for signaling (see option "Module for digital position feedback").

Alarm output

The alarms generated in the positioner can be polled via the digital output as a collective alarm.
The desired information can be selected via the LCD display or remotely via the configuration program.
The output can be set to "active high" or "active low", as required.

Digital input

For the digital input, one of the following safety options can be selected. You may use the LCD display or configuration program to select an option.
— No function (default)
— Move to position substitute value (freely selectable)
— Start "Partial Stroke Test"
— Ventilate output 1, evacuate output 2
— Ventilate output 2, evacuate output 1
— Service required
— Move to 0 % position
— Move to 100 % position
— Hold previous position
— Disable local configuration
— Disable local configuration and operation
— Disable all access (no local or remote access via a PC)
The selected function is activated once the 24 V DC signal is no longer applied (< 11 V DC).

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Adjustment parameters

The positioner has a special function for automatic adjustment of the parameters. Additionally, the control parameters can be set automatically (in adaptive control mode) or manually to optimally adapt them to the process requirements.

Zone

Upon reaching this value, the position is readjusted more slowly until the dead band is reached.

Dead band (sensitivity)

When reaching the dead band, the position is held.

Display 0 ... 100 %

Adjusting the display (0 ... 100 %) according to the direction of action for opening or closing the actuator.

Diagnostics

Various functions for permanent operational monitoring are implemented in the PositionMaster EDP300 operating program. The following states will be detected and indicated, e. g.:
— Setpoint signal out of range 0 ... 100 % or 4 ... 20 mA
— Position out of the adjusted range
— Positioning time-out (adjustable time parameter)
— Position controller inactive
— Counter limit values exceeded (can be set via DTM/EDD)

LCD display

The LCD indicator has a cover to protect against unauthorized operation.

Commissioning the positioner is especially easy. Autoadjust is triggered by pressing just a few pushbuttons. Detailed configuration knowledge is not necessary in order to start the device.
Depending on the selected actuator type (linear or rotary), the displayed zero position is automatically adapted.

Besides this standard function, a customized "Autoadjust" function is available. The function is launched either via the LCD display or HART communication.

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Fig. 6:   Open positioner with view of LCD indicator

The built-in LCD indicator with four pushbuttons supports the following functions:
— Operational monitoring
— Manual intervention during live operation
— Device configuration
— Fully automatic commissioning
— Display of diagnostic messages

M10126

Fig. 7:   LCD indicator with pushbuttons and LCD display

A menu-controlled configuration is available via the pushbuttons on the device.

The multi-line LCD indicator is permanently updated and adapted during operation to provide the user with optional information as relevant.

During control operation (control with or without adaptation) the following data can be called up by pressing the pushbuttons briefly:

— Position   Pos [%]
— Position   Pos [°]
— Setpoint   SP [%]
— Setpoint   SP [mA]
— Control deviation DEV [%]
— Electronics temperature [°C, °F, °R, K]
— Supply pressure   PIN [unit]
— Pressure output 1   PY1 [unit]
— Pressure output 2   PY2 [unit]
— Differential pressure   DP [unit]
— Universal input value UIN [unit]

— Malfunctions, alarms, messages
The possible reason is also displayed, along with the recommended remedial action.
In the event of an error, a message consisting of an icon and text (e.g., electronics) appears at the bottom of the process display. The text displayed provides information about the area in which the error has occurred.
The error messages are divided into four groups in accordance with the NAMUR classification scheme:

Symbol	Description
	Error / Failure
	Functional check
	Out of specification
	Maintenance required

(The group assignment can only be changed using a DTM or EDD.)

Additionally, the error messages are divided into the following areas:

Area	Description
Actuator	Diagnostics messages affecting the valve or the pneumatic actuator
Operation	Diagnostics messages affecting the operation of the positioner
Process	Diagnostics messages relating to the process and displaying problems or states
Sensor	Alarms informing of problems affecting the reading of the valve position
Electronic	Displays errors in the device electronics
Configuration	Detects if the positioner configuration is missing or faulty

Histograms recording
— Positioning time-outs
— Valve movements
— Valve strokes
— Most used valve position
— Universal input

Access to extended monitoring parameters is possible via HART communication, the DTM, and the EDD.

The diagnostics parameters in the operating program provide information about the operating conditions of the actuator. For example:
— Dead band time limit
— Leakage detection
— Temperature monitoring
— Stiction detection
— Sliding friction detection
— Hysteresis
— Valve seat wear

From this information the operator can derive what maintenance work is required, and when.

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Diagnostics with DTM

Access to extended monitoring parameters is possible via HART communication, in particular the DTM (reduced functions only with the EDD).

Butterfly diagnostics

The trend (which relates to a number of relevant positioner parameter values) can be used to draw conclusions about the stiction and friction of a valve with a view to enabling preventive maintenance.

If the diagnostic parameters have changed, a triangle is displayed in signal color. The color and size of this triangle represent the direction and scope of the change.
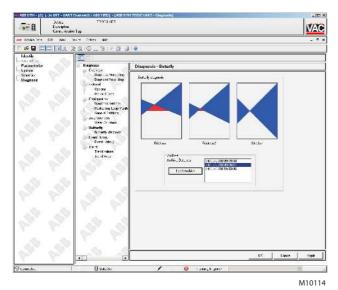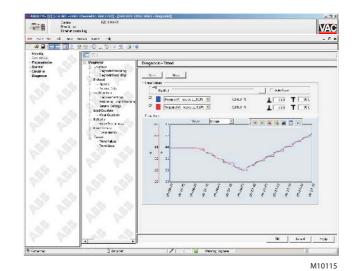

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Fig. 8:   Example for increased friction

Online trend archive

The online trend archive does not merely indicate the current setpoint and actual value, but also the associated patterns, which can stretch back over a matter of hours. When you start the online trend archive, the saved data is read out and transmitted at such a high transmission rate (100 ms via HART) that the latest data is displayed in next to no time.

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Fig. 9:   Example for online trend archive

Event history

Up to 100 events are saved in the event history in the device. The time each event occurred is also displayed, along with a suggested approach to solving the problem. The limit values for (pre-)alarms, e.g. a friction alarm, can be set.
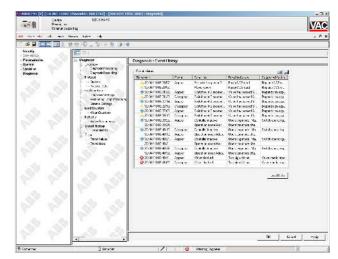

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Fig. 10:   Example event history

Valve signature (only with pressure option)

When the valve signature starts , the entire valve operating range is covered for the "open and closed directions". High-resolution plots are generated for the pressure patterns at the diagnostic pressure sensors. In addition, the signal waveform for the universal input is recorded. Once the signature has expired, the parameters selected by the user are loaded from the device and displayed. Depending on the quantity of data selected, it may take several minutes to transfer all the parameter values. Up to 5 valve signatures can be saved in the device; these can be compared so that valve diagnostics can be performed for the purpose of preventive maintenance.

Speed in relation to position test

When the "Speed in relation to position test" is started, the entire valve operating range is covered for the valve's "open and closed directions" in an uncontrolled manner using an adjustable degree of openness for the pneumatics. The positioning times for opening and closing the valves are displayed.

The pattern of the graph provides information about friction in the valve and actuator. Up to 5 archived graphs can be saved in the device; these can be compared so that valve diagnostics can be performed for the purpose of preventive maintenance.
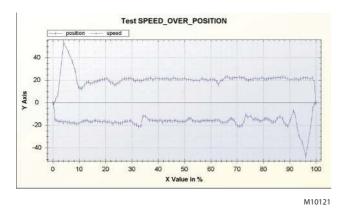

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Fig. 11:   Example of Speed Over Position Test

Step response test

The step response allows the user to define the start position for the step change. When the start button is pressed, a setpoint step change is generated internally and a high-resolution plot is created for the valve position, pressure patterns, etc. At the end of the step response, the actuator automatically moves to the defined start position and reverts to control mode. Depending on the quantity of data selected, it may take several minutes to transfer all the parameter values and display them in the form of a graph.

The pattern of the graph provides information about friction in the valve and actuator. Up to 5 archived graphs can be saved in the device; these can be compared so that valve diagnostics can be performed for the purpose of preventive maintenance.

Valve seat test

During the valve seat test, the actuator is moved in the direction of the 0 % position with maximum force.

If the user-defined tolerance window for the 0 % position or the universal input signal is exceeded, this will be shown as an error. This error may be indicative of deposits or extreme wear of the valve seat.

If an ultrasonic sensor is used at the universal input for the purpose of measuring noise at the valve seat, even minor leakage at the valve fitting can be detected.

At the end of the test, the positioner moves the valve to the last valid position and reverts to the most recently active control mode.

Leakage test (only with pressure option)

During the leakage test, the positioner closes all pneumatic outputs. Then, if the valve position changes or there is a change in the pressure patterns at the diagnostic pressure sensors, the positioner will be able to detect leakage. It outputs a message indicating the area of the pneumatic piping or actuator that is leaking.

At the end of the test, the positioner moves the valve to the last valid position and reverts to the most recently active control mode.

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Partial Stroke Test

The Partial Stroke Test is used to check the function of the safe position of ESD (emergency shutdown) valves.
The test can be started both locally on the device, time-controlled or using the DTM. The positioner evacuates output 1 until the position change defined in advance occurs. If this does not happen within the set time, an alarm can be output. This helps prevent unexpected failures of the valve.
At the end of the test, the positioner moves the valve to the last valid position and reverts to the most recently active control mode.
There are two separate parameters available for reducing the speed at which the valve moves in the corresponding direction.

Drag indicator

This diagram shows the minimum, maximum, and average values for a selectable parameter in 3 different intervals, which are offset in relation to one another. The drag indicator trend, which is plotted against time, makes it possible to plan preventive action so that a failure in terms of the valves and fittings can be avoided.

Trend histogram

This histogram shows, for example, the position range of the valve within which control is most frequently performed. The parameters to be displayed can be selected by the user. This graph can be used, for example, to determine the most commonly used valve position so that the valve design can be evaluated. The friction within a valve range can be determined on the basis of the differential pressure, dead band time limit alarms, etc.
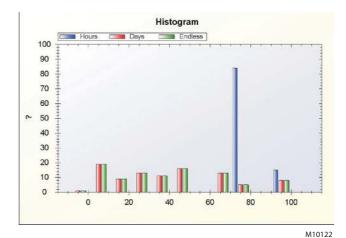

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Fig. 12: Example trend histogram

Trend diagram

This diagram indicates in which valve positioning range the greatest control deviation has occurred. This allows you to derive the valve friction, actuator size or supply air pressure.

Friction detection test (only with pressure option)

Once the function is initiated, a high-resolution plot of the differential pressure and universal input signal is generated for the valve's entire operating range.

At the end of the test, the positioner moves the valve to the last valid position and reverts to the most recently active control mode.

Limit values for the dynamic friction, stiction and universal input signal can be defined, using 11 reference points in each case. If the corresponding alarms are also activated in "Diagnostics -> Configure diagnostics", alarms can be output during operation as soon as the defined limit values are overshot.

Further diagnostic parameters are possible with the optional pressure sensors. They include:

— Supply air pressure too low
— Supply air pressure too high
— Pressure shocks in the supply air
— Valve signature
— Leakage localization

Additionally, limit values can be defined for these parameters. When they are exceeded, an alarm is reported.

The following values are e.g. determined:
— Number of movements performed by the actuator
— Total travel

Test cycles

Characteristic curves mapping a setpoint cyclically and internally are stored in the device. The DTM can be used to track the position of the actuator. This provides a means of checking the dynamic response of the entire actuator, for example, and determining the limit frequency automatically.
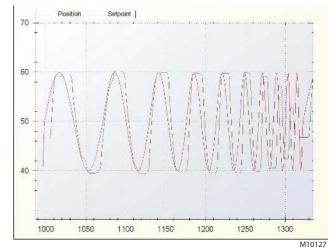

Fig. 13: Example test cycles

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Communication

DTM

The DTM (Device Type Manager) for the positioner
VAC D500 is based on FDT/DTM technology
(FDT 1.2/1.2.1) and can be either integrated into a control
system or loaded on a PC with DAT200 Asset Vision Basic.
This allows you to work with the same user interface in the
commissioning phase, during operation, and for service tasks
involving monitoring the device, setting parameters, and
reading out data.
Communication is based on the HART protocol. Reading data
out from the device has no effect on active operation.
Newly set parameters are saved in the non-volatile memory
directly upon download to the device, and become active
immediately.

EDD

The EDD (Electronic Device Description) is used to read and
modify simple device parameters on handheld terminals or in
the vicinity of the system.

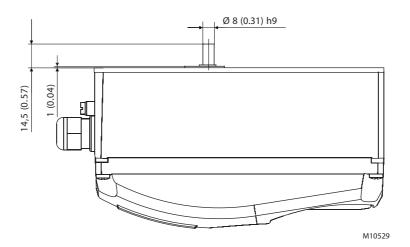# Dimensions

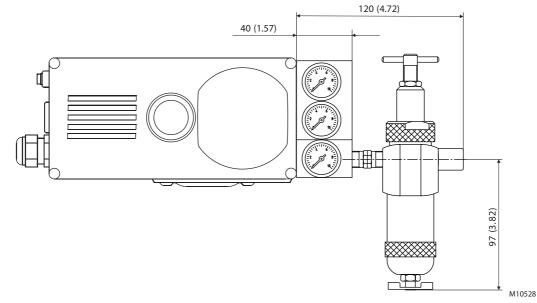Mounting drawings
All dimensions in mm (inch)

Fig. 14: Top view

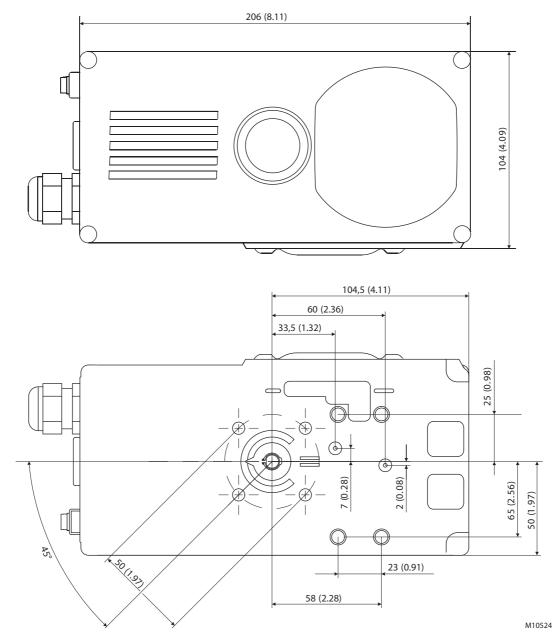Fig. 15: D500 positioner with pressure gauge block and filter regulator mounted

VAC D500
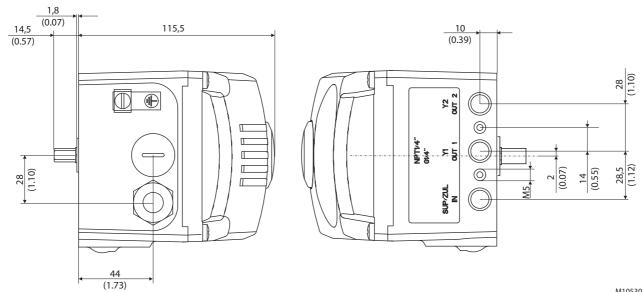## Electro-Pneumatic Positioner

Fig. 16: Front and rear views

1,8
(0.07)

14,5
(0.57)

115,5

28
(1.10)

44
(1.73)

10
(0.39)

28
(1.10)

Y2
OUT 2

NPT1/4"
G1/4"

Y1
OUT 1

SUP/ZUL
IN

M5

2
(0.07)

14
(0.55)

28,5
(1.12)

M10530

Fig. 17: Side view (from left to right)

30 / 53
(1.18 / 2.09)

75 (2.95)

M10134

Fig. 18: Mounting to linear actuators to DIN/IEC 534

25 (0.98)

45 – 75
(1.77 - 2.95)

B *

A*

M10135

Fig. 19: Mounting to rotary actuators to VDI/VDE 3845

*) Dimensions A and B are dependent on the rotary actuator

D500 15

Remote sensor dimensions (aluminum housing)

All dimensions in mm (inch)

Fig. 20: Top view

Fig. 21: Front and rear views
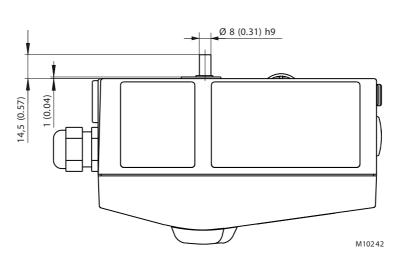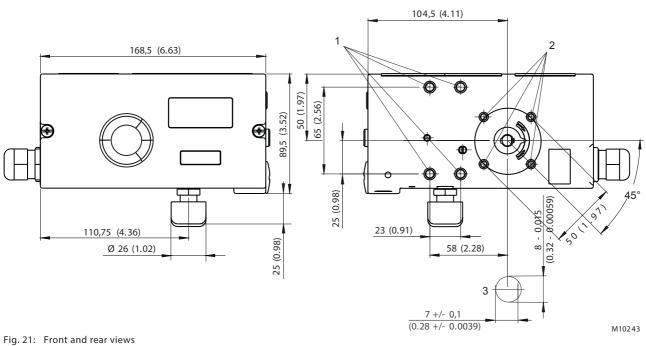1 Threaded hole M8 (10 mm (0.39 inch) deep) | 2 Threaded hole M6 (8 mm deep (0.31 inch)) | 3 Sensor shaft (shown enlarged)

Fig. 22: Side view (from left to right)

92 (3.62)

18 (0.71)

14 (0.55)

29 (1.14)

9 (0.35)

10 (0.39)

M5

14 (0.55)

14 (0.55)

2 (0.08)

3 (0.12)

M102 44

30 / 53
(1.18 / 2.09)

75 (2.95)

M102 45

Fig. 23: Mounting to linear actuators to DIN/IEC 534

45 - 75
(1.77 - 2.95)

25 (0.98)

B *

A*

M102 46

Fig. 24: Mounting to part-turn actuators to VDI/VDE 3845

*) Dimensions A and B are dependent on the part-turn actuator

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Electrical connections

VAC D500 with remote sensor

The VAC D500 version with remote sensor includes an adjusted unit with two housings.
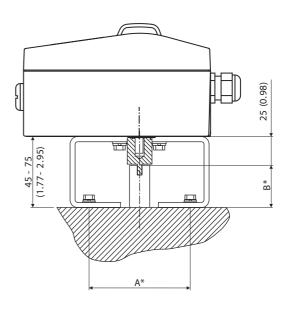
Housing 1 (D500 control unit) contains the electronics and pneumatics along with the following options (where applicable):
- Analog position feedback
- Digital position feedback
- Shutdown module
- Universal input

Housing 2 (D500 remote sensor) contains the position sensor and is suitable for mounting on linear or part-turn actuators. The following options can be installed if required:
- Optical position indicator
- Mechanical feedback contacts (proximity switch or microswitch design).

The two housings can be or are connected to a shielded 3-wire cable. The maximum cable length is 10 m.

For Housing 1 (control unit) an attachment kit is available for pipe and wall mounting (see Accessories).
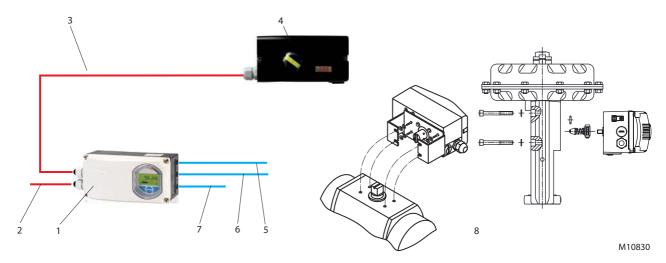

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Fig. 25: D500 control unit with remote sensor
1 Housing 1 (control unit) | 2 Setpoint signal | 3 Connection cable | 4 Housing 2 (remote sensor) | 5 Pneumatic output 2 |
6 Pneumatic output 1 | 7 Supply air | 8 Pneumatic drive

Optionally, both housings of the "D500 stainless steel remote sensor" design are available in stainless steel. The housing dimensions are identical in this case - and the attachment kits are suitable for all versions.

M10831

Fig. 26: D500 control unit made of stainless steel with D500 remote sensor made of stainless steel
1 Housing 1 (control unit) | 2 Setpoint | 3 Connection cable | 4 Housing 2 (remote sensor) | 5 Pneumatic output 2 |
6 Pneumatic output 1 | 7 Supply air | 8 Pneumatic drive

M10832

Fig. 27: Electrical connection
1 D500 control unit | 2 Remote sensor connection cable no. 3 | 3 Remote sensor connection cable no. 2 |
4 Remote sensor connection cable no. 1 | 5 Shielding | 6 D500 remote sensor

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VAC D500 for external remote sensor

In the VAC D500 design for remote sensor, the positioner is supplied without position detection.

The housing (D500 control unit) contains the electronics and pneumatics along with the following options (where applicable):

- Analog position feedback
- Digital position feedback
- Shutdown module
- Universal input

The D500 for remote sensor can be connected to any position sensor (4 … 80 kohms).
The length of the shielded 3-core cable must be a maximum of 10 m.
The installation and commissioning is carried out according to the respective chapters in the operating instructions.
For the housing (D500 control unit) an attachment kit is available for pipe and wall mounting. (See Accessories).

Fig. 28: D500 control unit for remote sensor
1 Housing (control Unit) | 2 Setpoint signal | 3 Connection cable | 4 External remote sensor | 5 Pneumatic output 2 |
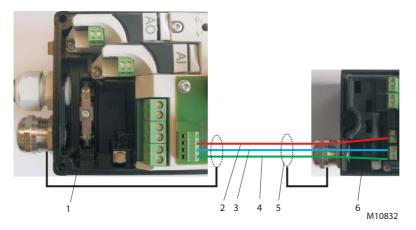6 Pneumatic output 1 | 7 Supply air | 8 Pneumatic drive

Fig. 29: Electrical connection
1 D500 control unit | 2 Remote sensor connection cable No. 3 | 3 Remote sensor connection cable No. 2 |
4 Remote sensor connecting cable no. 1 | 5 Shielding | 6 External remote sensor

Terminal connection diagrams

Fig. 30: Connection diagram of the D500 control unit
A Basic device | B Options
1 Setpoint signal | 2 Digital input | 3 Digital output | 4 Digital feedback | 5 Analog feedback |
6 Emergency shutdown module | 7 Universal input | 8 Remote sensor

Fig. 31: Connection diagram to the D500 remote sensor
A Basic device | B Options
1 D500 control unit | 2 Proximity switches | 3 Microswitch

VAC D500
Electro-Pneumatic Positioner

Technical Data

Inputs

Two-wire technology

Nominal range	4 ... 20 mA
Limit values	Max.: 50 mA (overload)
	Min.: 3.6 mA
Start	⊠ 3.8 mA
Load voltage at 20 mA	9.7 V
Impedance at 20 mA	485 Ω

Digital input

Control voltage	0 … 5 V DC (switching state logical "0")
	11 … 30 V DC (switching state logical "1")
Current	max. 4 mA

Outputs

Digital output (control circuit to DIN 19234/NAMUR)

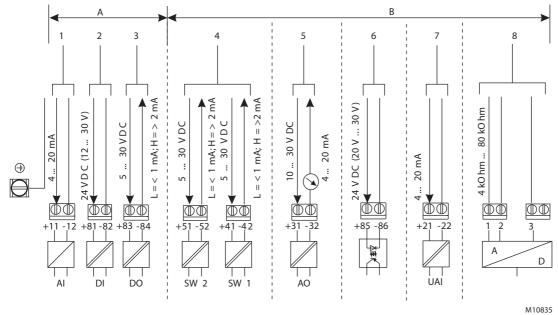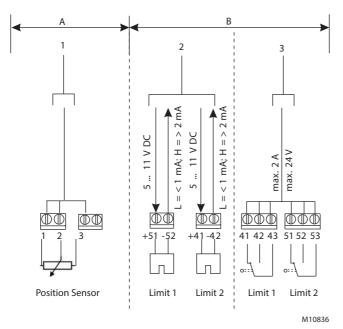|	
Supply voltage	5 ... 30 V DC
Switching state logical	"0": Current > 0.35 mA … < 1.2 mA
	"1": Current > 2.1 mA
Effective direction (configurable)	normally logical "0" or logical "1"

Cable connections

Electrical connections

4 … 20 mA input	Screw terminals max. 2.5 mm^2 (AWG 14)
Options	Screw terminals max. 1.0 mm^2 (AWG 18)
Cable entry	2 threaded bores 1/2-14 NPT/M20 x 1.5 (cable gland/pipe plug optional)

cross section

Rigid / flexible wires	0.14 ... 2.5 mm^2 (AWG 26 ... AWG 14)
Flexible with wire end sleeve	0.25 ... 2.5 mm^2 (AWG 23 ... AWG 14)
Flexible with wire end sleeve no plastic sleeve	0.25 ... 1.5 mm^2 (AWG 23 ... AWG 17)
Flexible with wire end sleeve with plastic sleeve	0.14 ... 0.75 mm^2 (AWG 26 ... AWG 20)

Multi-wire connection capacity (2 wires of the same cross section)

Rigid / flexible wires	0.14 ... 0.75 mm^2 (AWG 26 ... AWG 20)
Flexible with wire end sleeve no plastic sleeve	0.25 ... 0.75 mm^2 (AWG 23 ... AWG 20)
Flexible with wire end sleeve with plastic sleeve	0.5 ... 1.5 mm^2 (AWG 21 ... AWG 17)

Options

cross section

Rigid / flexible wires	0.14 ... 1.5 mm^2 (AWG 26 ... AWG 17)
Flexible with wire end sleeve no plastic sleeve	0.25 ... 1.5 mm^2 (AWG 23 ... AWG 17)
Flexible with wire end sleeve with plastic sleeve	0.25 ... 1.5 mm^2 (AWG 23 ... AWG 17)

Multi-wire connection capacity (2 wires of the same cross section)

Rigid / flexible wires	0.14 ... 0.75 mm^2 (AWG 26 ... AWG 20)
Flexible with wire end sleeve no plastic sleeve	0.25 ... 0.5 mm^2 (AWG 23 ... AWG 22)
Flexible with wire end sleeve with plastic sleeve	0.5 ... 1 mm^2 (AWG 21 ... AWG 18)

Please Contact Valve Accessories & Controls for Mounting kit information.

VAC D500
Electro-Pneumatic Positioner

Housing

Material / Degree of protection

Aluminum with ≤ 0.1% copper	Optional stainless steel 1.4404 (316L)
Degree of protection	IP 65 / NEMA 4X (NEMA 4X does not permit overhead mounting)

Surface / color (aluminum housing only)

Dipping varnish	With epoxy resin, stove-hardened
Housing varnished black	RAL 9005
	RAL 9002

Weight

Aluminum	2.4 kg (5.29 lb)
Stainless steel 1.4404 (316L)	5.5 kg (12.13 lb)

Mounting orientation

Any

Transmission data and influences

Output Y1

Increasing setpoint signal	0 ... 100 %
	Increasing pressure at output
Decreasing setpoint signal	0 ... 100 %
	Decreasing pressure at output

Action (setpoint signal)

Increasing setpoint	4 ... 20 mA
	= actuator position 0 ... 100 %
Decreasing setpoint	20 ... 4 mA
	= actuator position 0 ... 100 %

Characteristic curve (travel = f {setpoint signal})

Linear	Equal percentage 1:25 or 1:50 or 25:1 or 50:1 [1]
Deviation	< 0.5 %
Configurable zone	0 ... 100 %,
Configurable dead zone	0.1 ... 10 %,
Resolution (A/D conversion)	> 16,000 steps
Sample rate	20 ms
Ambient temperature influence	< 0.5 % for each 10 K
Influence of vibration	< 1 % to 10 g and 80 Hz

1) Freely configurable with 20 reference points

Seismic vibration

Meets requirements of DIN/IEC 60068-3-3 Class III for strong and strongest earthquakes.

Influence of mounting orientation

Not measurable.

Noise emissions

Max. 100 db (A)
Noise-reduced version max. 85 db (A)

Environmental capabilities

Ambient temperature range

For operation, storage, and transport	-40 ... 85 °C (-40 ... 185 °F)
When using proximity switches SJ2-S1N (NO)	-25 ... 85 °C (-13 ... 185 °F)

Relative humidity

Operational with housing closed and air supply switched on	95 % (annual average), condensation permissible
Transport and storage	75 % (annual average)

Explosion protection

FM certificate 3043773

IS, C1. I, Div 1, Grp. A, B, C, D, T4 or T6
IS, C1. II, Div 1, Grp. E, F, G, T4 or T6
IS, C1. III, Div 1, T4 or T6
Class I Zone 0, AEx ia IIC, T4 or T6
NI,CI. I,Div.2, Grp. A, B, C, D, T4 or T6
NI,CI. II,Div.2, Grp. E, F, G, T4 or T6
NI,CI. III,Div.2, T4 or T6
Class I Zone 2, IIC, T4 or T6
Enclosure type 4X

CSA Certification 2419437

Class I, Division 1, Groups A, B, C, D;
Class II, Division 1, Groups E, F, G;
Class III T4
Ex ia IIC T4
Class I, Zone =, AEx ia IIC T4

Optional upgrades

Module for analog position feedback [1]

Signal range	4 … 20 mA (configurable split ranges)
Supply, 2-wire circuitry	24 V DC (10 … 30 V DC)
Characteristic curve (configurable)	Increasing or decreasing
Deviation	< 1 %

Without a signal from the positioner (e. g., "no power" or "initializing") the module sets the output to > 20 mA (alarm level)

Module for binary position feedback [1]

Two switches for digital position feedback (position adjustable within the range of 0 … 100 %, ranges cannot overlap)
Current circuits acc. to DIN 19234 / NAMUR

Supply voltage	5 … 30 V DC
Signal current	< 1.2 mA: Switching state logical "0"
	> 2.1 mA: Switching state logical "1"
Direction of action	normally logical "0" or logical "1" (configurable)

Module for universal input [1]

Module for a 4 … 20 mA input for universal use.
The range can be scaled. It is used for advanced valve diagnostics. For example, an ultrasonic sensor can be connected to detect a faulty valve seat or a phonometer can be connected to detect cavitation. The limit values for detecting overshoot can be freely selected.

Universal input	
Nominal range	4 … 20 mA
Load voltage at 20 mA	8 V
Impedance at 20 mA	400 Ω

Module for the emergency shutdown function [1]

Supply voltage	24 V DC (20 … 30 V DC) (electrically isolated from input signal)
Safe position active	At voltage < 5 V

Explosion protection: see certificate (operating instructions)

1) There are two slots for the option modules. Any combination of different option modules is possible. However, identical option modules cannot be combined.

A separate 24 V DC signal is applied to the emergency shutdown module; it connects the signal from the microprocessor through to the I/P module.
When the 24 V DC signal is interrupted, the pneumatic module executes the respective safety function, depending on the mechanical construction:
The positioner output 1 is depressurized, and the valve is moved to the safe position. In case of a "double-acting" actuator the second output 2 is additionally pressurized.
The emergency shutdown module works independently of the mother board, i.e., all information from the actuator is available in the control system at any time.

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Binary position feedback with proximity switches

Two proximity switches for independent position signaling.
Switching points adjustable between 0 … 100 %
Current circuits acc. to DIN 19234 / NAMUR

Supply voltage	5 … 11 V DC
Signal current	< 1.2 mA: Switching state logical "0"
	> 2.1 mA: Switching state logical "1"

Direction of action (logical state)

	Position			
Proximity switch	< Lim. 1	> Lim. 1	< Lim. 2	> Lim. 2
SJ2-SN (NC)	0	1	1	0
SJ2-S1N (NO)	1	0	0	1

When using proximity switch SJ2_S1N (NO), the positioner
may only be used at an ambient temperature range
of -25 … 85 °C (-13 … 185 °F).

Binary position feedback with 24 V microswitches

Two microswitches for independent position signaling.
Switching points adjustable between 0 … 100 %.

Voltage	max. 24 V AC / DC
Load rating	max. 2 A
Contact surface	10 µm Gold (AU)

Mechanical position indicator

Indicator disk in enclosure cover, linked with positioner
feedback shaft.

Contactless position sensor (option)

In difficult ambient conditions (constant valve movements, for
example, which are transmitted to the sensor axis by the
process pressure), the positioner can be fitted with a
contactless position sensor.

Pressure option

The pressure option comprises 3 absolute pressure sensors
which facilitate pressure-based valve diagnostics (valve
signature, for example).
The supply air pressure and the output pressures can also be
monitored. The zero points of the pressure sensors can be
calibrated both locally on th e device and using the DTM.

These options are also available for retrofitting by Service.

Ex relevant specifications

Intrinsic safety gas and dust ATEX / IECEx

ZELM 11 ATEX 0456 X (EC type examination certificate)
II 1G Ex ia IIC T6 or T4 Ga
II 1D Ex iaD IIIC T55°C or T100°C Da
Ta = -40 ° … 40 ° or 85 °C

IECEx ZLM 11.0001 X
Ex ia IIC T6 or T4 Ga
Ex iaD IIIC T55 °C or T100°C Da
Ta = -40 ° … 40 ° or 85 °C

Temperature class	Ambient temperature	Surface temperature
T4	-40 … 85 °C (-40 … 185 °F)	100 °C (212 °F)
T6	-40 … 40 °C (-40 … 104 °F)	55° C (131 °F)

Electrical connections gas and dust ATEX / IECEx
Signal circuit (AI) (terminals +11 -12)

Temperature class T1 – T4	Temperature class T6
U_i = 30 V	U_i = 28 V
I_i = 320 mA	I_i = 320 mA
P_i = 1.1 W	P_i = 0.8 W
C_i = 6.5 nF without pressure option	
C_i = 8.8 nF with pressure option	
L_i = negligibly small	

Switching input (DI) (terminals +81 -82)

Temperature class T1 – T4	Temperature class T6
U_i = 30 V	U_i = 28 V
P_i = 500 mW	P_i = 400 mW
C_i = 4.2 nF	
L_i = negligibly small	

Switching output (DO) (terminals +83 -84)

Temperature class T1 – T4	Temperature class T6
U_i = 30 V	U_i = 28 V
P_i = 500 mW	P_i = 400 mW
C_i = 4.2 nF	
L_i = negligibly small	

Shutdown module (terminals +41 -42)

Temperature class T1 – T6
U_i = 30 V
P_i = 1 W
C_i = 5.3 nF
L_i = negligibly small

Analog feedback module (terminals +31 -32)

Temperature class T1 – T4	Temperature class T6
U_i = 30 V	U_i = 28 V
I_i = 320 mA	I_i = 320 mA
P_i = 1 W	P_i = 0.8 W
C_i = 11.3 nF	
L_i = 150µH	

Universal analog input module (terminals +21 -22)

Temperature class T1 – T4	Temperature class T6
U_i = 30 V	U_i = 28 V
I_i = 320 mA	I_i = 320 mA
P_i = 1 W	P_i = 0.8 W
C_i = 11.3 nF	
L_i = 150µH	

Digital feedback module
(terminals: SW 1: +41 -42, SW 2: +51 -52)

Temperature class T1 – T4	Temperature class T6
Per output:	Per output:
Ui = 30 V	Ui = 28 V
Pi = 0.5 W	Pi = 0.4 W
I_i = 250 mA	
C_i = 2.2 nF per output	
Li = negligibly small	

Digital output module (proximity switches)[1]
(terminals limit 1: +51 -52, limit 2: +41 -42)

Temperature class T1 – T4	Temperature class T6
According to EC type examination certificate PTB 00 ATEX 2049X	

1   No IECEx

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Equipment in type of protection "n" or device dust ignition protection through housing "tb"

ZELM 11 ATEX 0456 X (EC type examination certificate)
II 3G Ex nA IIC T6 or T4 Gc
II 2D Ex tb IIIC T55°C or T100°C Db
Ta = -40 ° … 40 ° or 80

IECEx ZLM 11.0001 X
Ex nA IIC T6 or T4 Gc
Ex tb IIIC T55 °C or T100°C Db
Ta = -40 ° … 40 ° or 80

Temperature class	Ambient temperature	Surface temperature
T4	-40 … 80 °C (-40 … 176 °F)	100 °C (212 °F)
T6	-40 … 40 °C (-40 … 104 °F)	55° C (131 °F)

Electrical connections non-sparking ATEX/IECEx

Equipment in type of protection "n" or device dust ignition protection through housing "tb"

Signal circuit (AI) (terminals +11 -12):
$I_N \leq 22$ mA
$U_{max} \leq 30$ V

Switching input (DI) (terminals +81 -82):
$U_N \leq 30$ V

Switching output (DO) (terminals +83 -84):
$U_N \leq 30$ V

Shutdown module (terminals +41 -42):
$U_N \leq 30$ V

Analog feedback module (UAI) (terminals +31 -32)
$I_N \leq 22$ mA
$U_N \leq 30$ V

Universal analog input modu le (terminals +21 -22)
$I_N \leq 22$ mA
$U_{max} \leq 30$ V

Digital feedback module
(terminals: SW 1: +41 -42, SW 2: +51 -52)
Per output:
$U_N \leq 30$ V

Digital output module (proximity switches)
(terminals limit 1: +51 -52, limit 2: +41 -42)
Per output:
$I_N \leq 25$ mA
$U_N \leq 16$ V

When using proximity switch SJ2_S1N (NO), the positioner may only be used at an ambient temperature range of -25 … 80 °C (-13 … 176 °F).

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